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ABSTRACT

An empirical examination was undertaken to determine the relationship between reading problems diagnosed by experienced reading clinicians and the initial treatment plans proposed by them for a case. Twenty-four diagnosis/treatment protocols for eight experienced reading clinicians were analyzed in terms of clinician agreement on treatment categories within and across cases, association of diagnosed problems with treatments (PTA), and the correlation between diagnostic consistency and remedial consistency. Results showed that while the clinicians studied agreed on the use of a subset of treatments across almost all the cases, the extent of agreement varied. For any given diagnosis, diagnostic statements outnumbered treatment statements four to one. Of those treatments that were offered, approximately half were composed of some combination of the five core treatments (phonics, word analysis, sight words, visual discrimination/memory, and oral reading). Clinicians with lower diagnostic agreement had lower PTA agreement; those with higher diagnostic agreement had higher PTA agreement. (FL)

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THE RELATIONSHIP BETWEEN DIAGNOSIS AND REMEDIATION IN READING: A PILOT STUDY

Annette Weinshank

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Abstract

This study presents the results of analyzing 24 diagnosis-treatment protocols for eight experienced reading clinicians. The protocols were analyzed in terms of clinician agreement on treatment categories within and across cases, association of diagnosed problems with treatments, (PTA) and the correlation between diagnostic consistency and remedial consistency.

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The Relationship Between Diagnosis and Remediation in Reading: A Pilot Study

Annette Weinshank[1]

Rationale

The purpose of this study is to provide an initial mapping of the nature of the relationship between diagnosis and remediation in reading.

An abundance of professional opinion in the area of reading (Bond & Tinker, 1967; Kennedy, 1971; Lerner, 1976; Cawley, Goodstein, & Burrow, 1972) maintains that diagnosis is the key to appropriate remediation; that an effective treatment program is predicated upon a diagnosis which accurately establishes the current state of the client experiencing reading difficulties.

That diagnosis and remediation ought to bear a strong relation to one another is unargued. Whether or not they actually do is a matter of empirical investigation. Such an investigation has not, until now, been undertaken.

While techniques have been developed for studying the clinical problem-solving behaviors of physicians (Elstein, Shulman, & Sprafka, 1978; Vinsonhaler, Wagner, & Molidor, Note 1) and reading clinicians (Bader, Vinsonhaler, Gardner, Wagner, Shulman, Elstein, & Weinshank, Note 2; Weinshank, Note 3) as they diagnose simulated cases, these techniques have not yet been extended to treatment formulation.

This exploratory study uses data gathered during an observational study of reading clinicians as they diagnosed simulated cases of reading

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[1]Annette Weinshank is a research intern with IRT's Clinical Studies Component.

difficulty and then proposed an initial treatment plan.

Background

An analysis of the diagnostic reasoning of expert physicians as they interacted with simulated cases has led to the formulation of an inquiry theory of medical diagnostic problem solving (Elstein, Shulman, & Sprafka, 1978). The theory has also been used to guide the study of clinical reasoning of experienced reading diagnosticians interacting with simulated cases of reading difficulty (Bader et al., Note 2).

The inquiry principle of clinician simulation postulates that the major events in the clinical interaction are determined in a weighted probabilistic fashion[2] by the case on the one hand, and the clinician's memory and strategy on the other (Vinsonhaler, Wagner, Elstein, & Shulman, Note 4).

Case Principle: Diagnosis

A case is characterized by a set of problems to be diagnosed together with accompanying cue names and associated measured values (e.g., cue name: Slosson Oral Reading Test; cue value: [grade level] 2.5).

Clinician Principle of Diagnosis: Clinical Memory and Strategy

The clinician's memory is the store of memories for: (1) problems {P}, (2) cue names and values {C}, (3) the association of cues and problems {R (C,P)}. The following is an example of clinical diagnostic memory in reading:

1. Problems {P} -- Child will not attempt to independently analyze an unknown word.
2. Cue values{C} -- Given the Gates McKillop subtest, "Recognizing and Blending Common Word Parts," the child receives a low blending score.
3. Associating (relating) cues and problems {R (C,P)} -- Considering the Gates McKillop score, the likelihood of a phonics-application problem is high.

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[2] Weighted probabilistic fashion means that the clinical interaction is characterized by a lack of certainty as to outcome, and that within that interaction, some events are more likely to occur than others.

The clinician's diagnostic memory contains representations of cues, problems, and their relationship.

The diagnostician's clinical strategy consists of a general approach to the basic information gathering and information processing tasks required to make diagnostic decisions, i.e., a planned sequence of information processing tasks using the clinical memory to make decisions about diagnosis (Vinsonhaler, Wagner, Elstein, & Shulman, Note 4).

The four major information-processing activities which are used iteratively by the diagnostician are:

1. Cue acquisition: The process of gathering data, beginning with initially available cues (case information).

2. Hypothesis generation: The process of generating alternative explanations, or hypotheses, for the problem based on cues examined. These hypotheses are used to guide subsequent data collection.

3. Cue interpretation: The process of interpreting the case data based on the hypotheses being entertained.

4. Hypothesis evaluation leading to diagnosis judgment: The process of combining information to reach a diagnostic judgment.

Thus the Inquiry Theory asserts that diagnostic clinical interaction is a weighted probabilistic function of the case and the clinician's memory and strategy which yields a diagnosis: What is the most likely problem, i.e., the current state of the case?

The clinical interaction does not end with the diagnosis, however. A treatment plan must be proposed: What action can be taken to solve the problem, i.e., what will move the client to a more desirable state?

Clinician Principle of Therapeutics: Clinical Memory and Strategy

The clinician's therapeutic memory is the store of: (1) associations of problems with appropriate treatments, and (2) associations of treatments

with specific instructional prescriptions. The following is an example of clinical therapeutic memory in reading:

1. Associating problems with appropriate treatments {R (P,T)} -- Improve independent analysis of unknown words by first using serial substitution of initial consonants in regularly spelled words.

2. Associating treatments with specific instructional prescriptions {R (T,R_x)} -- With aide or peer tutor, drill using word wheels 15 minutes daily until child can blend discrete parts into whole word.

The diagnostician's clinical therapeutic memory contains representations of problems, treatments, and their relationship.

The two information-processing activities used by the diagnostician in formulating the initial treatment plan are treatment evaluation and prescription selection.

1. Treatment evaluation: The estimation of the expected gain for each of the relevant treatments, given the diagnosis.

2. Prescription selection: The process of relating overall treatment to specific methods of implementation.

In sum, the Inquiry Theory of clinical problem solving asserts that clinical interaction is a weighted probabilistic function of the case and the clinician's memory and strategy which yields (1) a diagnosis and (2) an initial treatment (remediation) plan.

General Theory of Treatment Evaluation

According to the model, diagnosis determines in weighted probabilistic fashion the decision about treatment {R (P,T)}. However, in formulating the initial treatment plan, case-specific constraints on treatment effectiveness must also be considered {R (P,T, Case)}.

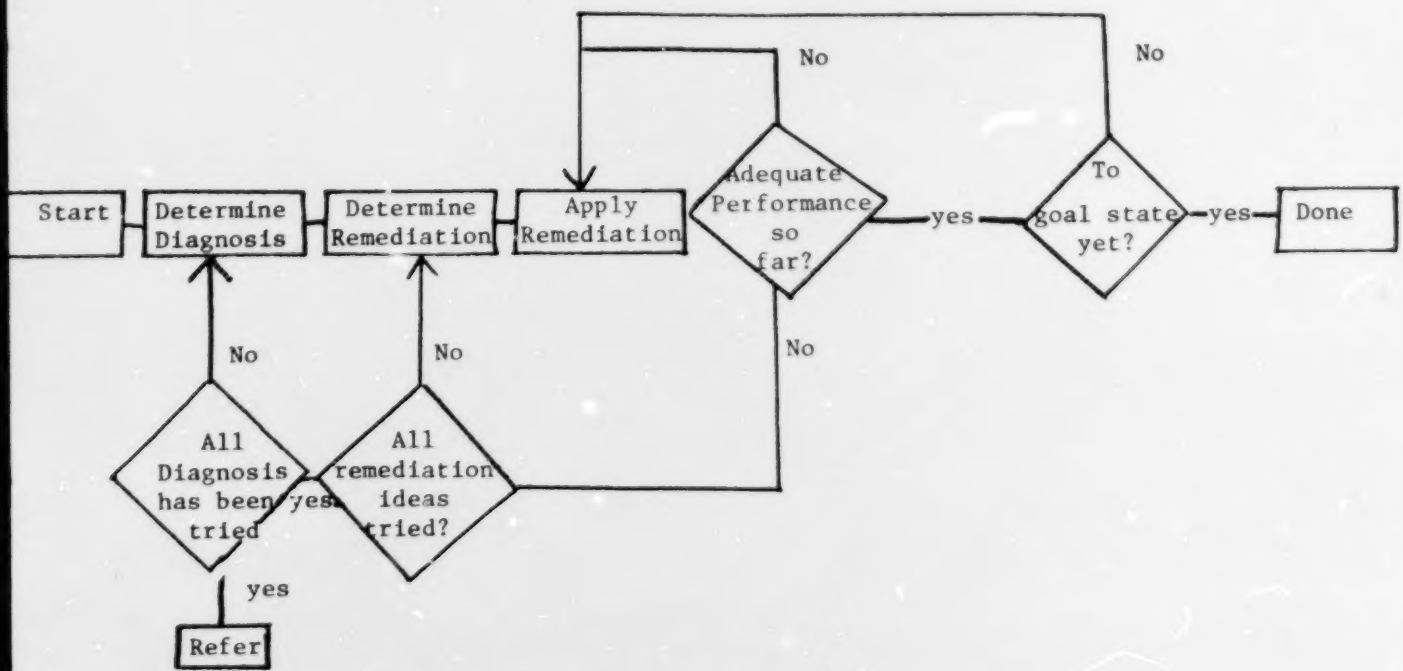
The treatment must be the most effective one. That is, after relevant alternative treatments have been examined, the one chosen must have incorporated relevant constraints and be evaluated as being the most

effective for the improvement of the patient's condition. Included in this evaluation are questions of cost (in terms of time, money, inconvenience, etc.), safety, availability, absence of contraindication, and preferences of both clinician and client (Vinsonhaler, Wagner, Elstein, & Shulman, Note 4).

In reading, decisions about which subset of remediations to choose for the initial plan must also take into account external environmental conditions in which the remediation will take place (e.g., class size, availability of support personnel and/or materials, time constraints, etc.) as well as those characteristics internal to the diagnosed student.

While this study is concerned with the relationship between diagnosis and initial treatment plan, it must be kept in mind that ultimately a treatment plan must move the client to a more desirable state. This means that as treatment progresses, the ongoing response of the student to it will generate new cues which may require alteration of the treatment in order to reach the desired goal (Shavelson, 1976). (See Figure 1.)

Figure 1



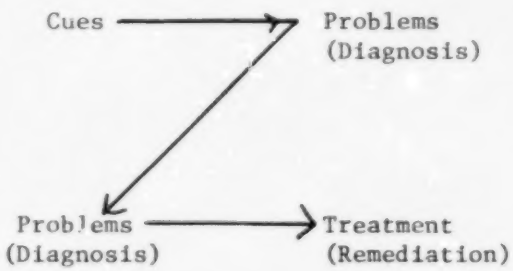
In sum, the clinical Inquiry Theory states that diagnosis determines in a weighted probabilistic fashion initial decisions about treatments, which in turn should incorporate constraints of the particular therapeutic setting.

The Problem-Treatment Association Corollary

Adequate knowledge of the relationship between cues and problems is central to correct diagnosis, and adequate knowledge of the relationship between the same problems and their treatments is central to effective remediation. Problem identification links the diagnosis-remediation relationship, resulting in a problem-treatment association (PTA) corollary:

$\{R\ (C, P)\}$

$\{R\ (P, T)\}$



The PTA Corollary has two parts:

1 Remediation is dependent on the diagnosis. (The probability of choosing an effective treatment given a specific problem is greater than the probability of choosing a treatment-in-general.) $Pr\ (T_i|P_i) > Pr\ (T_i)$. Treatments, therefore, are not independent of problems.

2. The greater the similarity (i.e., common problems identified) between diagnoses of replicate cases, the greater could be the similarity of treatments for those cases. Those clinicians with lower diagnostic agreement should have lower remedial (PTA) agreement; those with higher diagnostic agreement should have higher remedial (PTA) agreement.

The use of the PTA Corollary requires that problem-equivalent classes of treatments be established when analyzing data. That is, there can be remediations which are equivalent with respect to a given problem but which may be affected by case constraints (e.g., age of client) and appear, superficially, to be non-equivalent. (For example, an older and a younger child may both have the same problem analyzing multi-syllabic words. The specific form that the instructional prescription takes may well be quite different for the two children, but the remediation can be functionally equivalent with respect to the problem. The relationship between cue, problem, and treatment would still hold.)

In this study, an empirical examination was undertaken to determine the relationship between reading problems diagnosed by experienced reading clinicians and the initial treatment plans proposed by them for a case and its superficially disguised replicate.

Observational Study, 1977

A pilot study (Lee & Weinshank, Note 5) and an observational study (Weinshank, 1978) conducted by the Institute for Research on Teaching at Michigan State University to investigate the clinical problem solving of reading diagnosticians were the source of data for this report. For the observational study, four SIMCASES (SIMulated CASES of reading difficulty) were developed, each representing different, but commonly encountered types of reading difficulty in children in grades three to seven.

Eight highly trained, experienced reading diagnosticians participated in the observational study. During a five-week period, each diagnosed three SIMCASES. For each clinician the third case was a superficially disguised replicate of the first, while the second presented one of several different reading problems. For each of the three cases, the clinicians

were asked to think aloud as they requested data, generated hypotheses, and formulated diagnoses. When they had finished, they were asked to write out both the diagnosis and a proposed treatment plan. They did not discuss the treatment plan before writing it down. In total, the observational study consisted of 24 such sessions (runs), each comprising a diagnosis and accompanying remediation.

All analyses were based on the clinicians' diagnostic performance on Cases 1 and 3. The major finding was that there was, on the average, a very slight positive association between problems listed in diagnosing Case 1 and problems listed in diagnosing replicate Case 3. The average contingency coefficient for clinicians on replicated cases was 0.14 (range of 0.00 to 0.30). This measure of consistency represented the degree of reliability with which a clinician arrived at the same diagnoses for the replicated cases.

The Inquiry Theory states that diagnosis determines treatment in a weighted probabilistic fashion given that constraints are accounted for. To postulate otherwise would be to disengage diagnosis as a necessary prerequisite to treatment. If remedial agreement is markedly lower or higher than diagnostic agreement, then treatment must be either a chance-level, ad hoc response to each case, or a response chosen from a relatively stable armamentarium of procedures used across a broad range of cases, largely irrespective of case-specific characteristics.

Analysis Procedures

The 24 remediation protocols were coded for analysis (without reference to the preceding diagnoses) as follows. All independent statements were identified and labeled, each statement being numbered sequentially and categorized as one of the following:

D_x -- Diagnostic (problem) statement only

R_x -- Remedial (treatment) statement only

D_x-R_x -- Problem statement together with associated treatment(s)

Treatment Commonality

The degree of inter-clinician agreement (commonality) for treatments was determined for each clinician across each of the four cases (six runs per case). Any treatment mentioned two or more times in two or more runs for each case was retained for purposes of calculating each clinician's commonality index.

Treatments judged as equivalent were pooled into one treatment set. For example, substitution in word families, using word wheels, highlighting suffixes, and identifying word chunks were grouped as being treatments related to problems with word analysis.

PTA Consistency

PTA consistency measured intra-clinician consistency between diagnosis and remediation of replicate cases. For each clinician, the diagnoses from Runs 1 and 3 were compared with their respective remediations. The assumption underlying the measurement procedure is that for every diagnostic problem there is one treatment set.

$$P = \left\{ P_1, P_2, P_3, \ldots . P_N \right\} = \bigcup_{i=1}^{N} D_{xi}$$

$$T = \left\{ T_1, T_2, T_3 \ldots . T_N \right\} = \bigcup_{i=1}^{N} R_{xi}$$

Where UD_{xi} = the universe of diagnoses proposed for a given case and UR_{xi} = the universe of remediations for the same case.

For a given case in this study, there was a universe of problems which was equal to the total number of non-redundant diagnoses given by the clinicians diagnosing that case. A given clinician had a subset from that universe and a corresponding subset of treatments. As we have seen, remedial statements were categorized as either problem statements, treatment statements, or problem-treatment combinations. A four-fold contingency table (see Figure 2) accounted for the permutations involved in matching the prior diagnosis and remediation for each clinician for Runs 1 and 3.

Figure 2

DX \ R_x	−	+
−	N−− Those problems in the universe not mentioned and not treated.	N−+ Problems not mentioned in the diagnosis, but treated.
+	N+− Problems mentioned in the diagnosis, but not treated.	N++ Problems both mentioned in the diagnosis and treated.

A chi square and a contingency coefficient were calculated for each clinician. The coefficient expressed the correlation between problems stated and treatments proposed for the replicate cases.

A Pearson-Product Moment Correlation was calculated to determine the relationship between diagnostic consistency and PTA consistency.

Results

Treatment Commonality

Agreement on treatment categories varied across the four cases. The extent of agreement among clinicians is shown in Figure 3 below. If all clinicians for a case agreed on the same treatments, case agreement would be 1.0. If there were no agreement, the value would be 0.0.

Figure 3

1. Case (D/B): $\bar{X}$ = .65 (range 0.50 to 0.87)
2. Case (S/A): $\bar{X}$ = .62 (range 0.31 to 0.73)
3. Case (M/A): $\bar{X}$ = .46 (range 0.25 to 0.50)
4. Case (D/T): $\bar{X}$ = .34 (range 0.13 to 0.50)

Overall, mean agreement was 0.52.

A total of 17 treatment categories was suggested across the four cases. However, five categories were mentioned across two or three cases, while the remaining 12 were mentioned in conjunction with only one case. The five treatment categories and their frequency of appearance across the four cases were: phonics skills (two cases); visual discrimination/memory (3 cases); sight words (3 cases); word analysis (3 cases); and oral reading (2 cases). (See Appendix A.)

Problem-Treatment Association (PTA) Consistency

A mean correlation of 0.40 (range 0.19 to 0.57) between problems listed in the diagnosis and treatments proposed in the remediation for the replicate cases was observed. According to the first part of the PTA Corollary, remediation (treatment) is dependent on diagnosis (problems).

The less the diagnostic consistency for a replicate case, the less the validity of the remediation for that case. This can be illustrated as follows. If identical problems are not identified as such, treatments for them will differ, when they should be the same. Also, if problems identified in one case are omitted from the replicate diagnosis, treatments will be incomplete. Diagnostic agreement, or reliability, then, is a predictor for the validity of the remediations. In this study, mean diagnostic consistency was 0.14. Since validity cannot exceed the square root of reliability (and assuming that 0.14 is itself a reliable value), the predicted relationship between diagnosis and treatment in this study should not exceed [0.37 [$\sqrt{0.14}$ = 0.37].

The obtained mean value for PTA consistency, the relationship of problems to treatments, was 0.40. The discrepancy between 0.37 and 0.40 can be accounted for by error of measurement in arriving at values for diagnostic and PTA consistency.

By squaring the correlation ($r^2=0.40^2=0.16$), one arrives at the value (0.16) for amount of variance accounted for in predicting PTA consistency from diagnostic consistency. That is, 0.16 of the variation in treatments is attributable to the correlation with problems stated in the diagnosis. The remaining 0.84 represents remedial variance unaccounted for in terms of the preceding diagnosis.

There are additional observations which merit further exploration. All clinicians listed substantially more diagnostic problems than treatments, with ratios ranging from 2:1 to 7:1. Half of the clinicians had ratios of 4:1, four diagnostic statements for every treatment in the remediation. Diagnosis appears to be more far ranging than is treatment.

A closer examination of treatment statements revealed that the mean proportion of the five commonly agreed upon treatment categories relative to total treatments offered was 0.46. In other words, for each clinician, irrespective of case-specific problems, there was always a core set of treatments present in each remedial plan. On the average, half of each remediation plan consisted of some combination of the five core treatments.

In a further exploration of the data, each clinician's PTA consistency was recalculated, this time with all core treatments deleted from the remediations. Mean PTA consistency fell from 0.40 to 0.27 (range 0.02 to 0.59). One can speculate, perhaps, that diagnostic inconsistency is somewhat offset by the presence of a relatively stable set of core treatments across cases.

Finally, even if diagnostic consistency were increased and similar problems were recognized as such in replicate cases, it would not necessarily follow that corresponding treatments would be proposed. On the other hand, not accounting for similar problems in replicate cases can result in a greater reliance on a stable set of core treatments. Diagnostic inconsistency, then, sets limits on the reliable identification of specific problems and hence their likelihood of being systematically remediated.

Diagnostic Consistency and PTA Consistency

A correlation of 0.44 was observed between diagnostic consistency and remedial consistency across clinicians. This is congruent with the second part of the PTA Corollary, which states that the greater the similarity (i.e., common problems identified) between diagnoses of replicate cases, the greater should be the similarity of treatments for

those cases. Although mean diagnostic agreement was quite low (0.14), there were substantial individual deviations with respect to the mean (range 0.00 to 0.30). Those clinicians with lower diagnostic agreement also had lower PTA agreement. Those with higher diagnostic agreement had higher PTA agreement (see Appendix B).

Summary

It appears from the data presented herein that while the clinicians studied agreed on the use of a subset of treatments across almost all the cases, the extent of agreement varied. For any given diagnosis, PTA consistency was 0.40 -- diagnostic statements outnumbering treatment statements 4 to 1. Of those treatments that were offered, half, on the average, were composed of some combination of the five core treatments (phonics, word analysis, sight words, visual discrimination/memory, oral reading). When core treatments were removed from the remediations, PTA consistency fell to 0.27.

Diagnostic consistency and remedial consistency had a correlation of 0.44. Clinicians with lower diagnostic agreement had lower PTA agreement; those with higher diagnostic agreement had higher PTA agreement.

Limitations

It would be a mistake to overgeneralize the results of this study because of several factors: (1) small sample size, (2) the need for further refinement of the measurement techniques used to determine diagnostic agreement, and (3) the subjectivity involved in determining treatment equivalents and problem-treatment relationships.

The over-diagnosis recorded (relative to treatment) may have been the result of the clinicians' responses to the perceived demands of the

experimental environment. In addition, the use of SIMCASEs as opposed to real children may have drawn responses unlike those used by clinicians in natural settings.

Discussion

If diagnosticians, as a group, are indeed unable to reliably diagnose similar problems, then core treatments of accepted efficacy would clearly be the strategy of choice for dealing with reading problems. If this is the case, then treatment does, in practice, become effectively disengaged from diagnosis, perhaps reflecting hard, field-based realities.

Should subsequent research in this area replicate these effects, a number of questions will need to be addressed: (1) Can diagnosticians be trained to increase their diagnostic reliability? (2) Would increased reliability of problem identification necessarily lead to remediations which include relevant, agreed-upon differential treatments? (3) Does treatment represent what reliably can be done given field realities, as opposed to what ought to be done given a reliable diagnosis? If this is the case, then what is to be the role of diagnosis in the treatment of reading disabilities?

The results of this pilot study have underscored the necessity of conducting a full scale observational study devoted to remediation. Such a study is currently being planned. Its purposes will be twofold: (1) to extend the methodology of studying clinical problem solving into the area of remediation; and (2) to objectively measure the specific nature of the relationship between diagnosis and remediation.

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Appendix A

Treatment Commonality Across Cases

Treatments for:	No. of Cases (out of 4)
Phonetic Skills	2
Visual Discrimination/Memory	3
Sight Words	3
Word Analysis	3
Oral Reading	2
Auditory Memory	1
Visual-Motor Skills	1
Handwriting	1
Spelling	1
Punctuation	1
Study Skills	1
Listening	1
Hearing	1
Feedback	1
Motivation	1
Context Clues	1
Comprehension	1

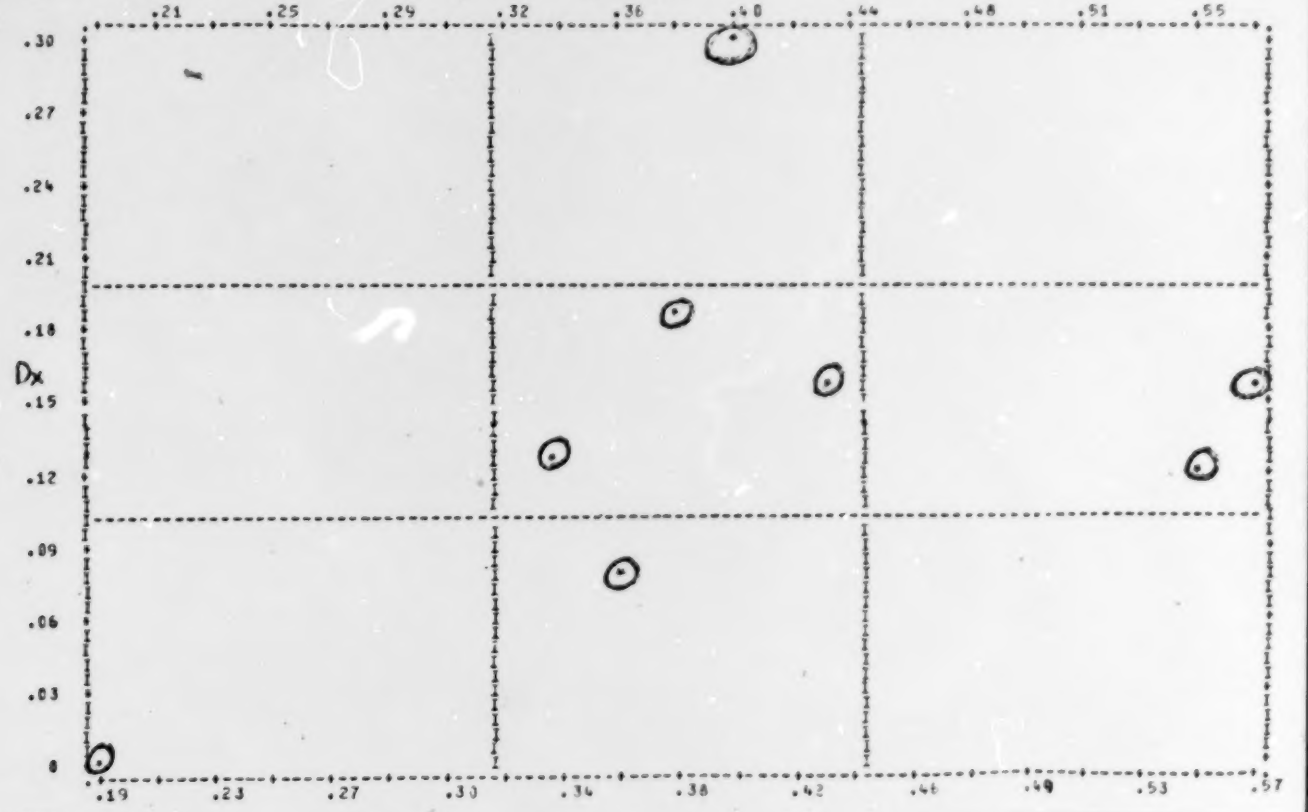
Appendix B

Scattergram of the Relationship Between Diagnostic Consistency and Remedial (PTA) Consistency.

ANNETTE WEINSHANK CORRELATION 09/29/78 SPSS V7.0 21.18.31. PAG

FILE NONAME (CREATION DATE = 09/29/78)

SCATTERGRAM OF (DOWN) DX (ACROSS) RX



STATISTICS..

CORRELATION (R) -	.44197	R SQUARED -	.19534	SIGNIFICANCE R -	.13645
STD ERR OF EST -	.08395	INTERCEPT (A) -	.01478	STD ERROR OF A -	.10991
SIGNIFICANCE A -	.44871	SLOPE (B) -	.31731	STD ERROR OF B -	.26292
SIGNIFICANCE B -	.13645				
PLOTTED VALUES -	8	EXCLUDED VALUES-	0	MISSING VALUES -	0

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